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AUTHOR Good, Thomas L.; Brophy, Jere E.
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ABSTRACT

A method of interaction analysis in which the individual student is the unit of analysis in classroom studies is needed to complement traditional studies treating the class as the unit. Such a method would add information concerning intra-class variation in teacher-pupil interaction patterns. Treatment of the studied are properly conceptualized as interactions between the teacher and the class as a group; and (2) teachers are consistent across students in their classroom behavior so that individual differences within a classroom are of little or no importance relative to intra-class differences. In fact many coding categories are most properly conceptualized as interactions between teacher and individual student. Within-class group and individual differences of considerable importance are regularly found when investigators look for them. Use of the individual student as the unit of analysis constitutes a more powerful method of examining the relationship between previously studied teacher behavior variables and student performance measures. It also allows interaction analysis techniques to be used on problems and variables not previously studied. Practical application of the improved method has been achieved in a study designed to identify and measure the behavioral mechanisms underlying the transmission of teacher expectancies for children's performance. (Author/JS)

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ANALYZING CLASSROOM INTERACTION: A MORE POWERFUL ALTERNATIVE

Thomas L. Good
Jere E. Brophy

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ANALYZING CLASSROOM INTERACTION:
A MORE POWERFUL ALTERNATIVE

Thomas L. Good and Jere E. Brophy

Abstract. This paper discusses the advantages of treating the individual student as the unit of analysis in classroom studies, arguing that this method is needed to complement those treating the class as the unit by adding information concerning intra-class variation in teacher-pupil interaction patterns. Applications to educational research are discussed, and a specific example is provided from the authors' work on a topic of present interest -- the attempt to identify and measure the behavioral mechanisms underlying the transmission of teacher expectancies for children's performance (Rosenthal and Jacobson, 1968).

The development of observation schedules for classroom interaction analysis has a long history in educational research, but it has become increasingly popular in recent years. Simon and Boyer (1968) describe 26 observation schedules in detail but indicate that over 50 such systems are presently in use. Although these systems differ in many ways, they tend to share certain common features: they tend to be universal systems which code all teacher and student behavior into one of the available categories, rather than ignore certain behavior and concentrate on a previously specified subset of classroom events; the measures derived from them tend to be frequency counts and their derivatives, with built-in qualitative or evaluative distinctions in behavior usually not included; analysis usually treats the class as a unit, ignoring differences among individuals in the same class. Such

systems have been successfully used for studying demographic characteristics of classroom life, understanding teacher-class verbal interactions, gathering information about pedagogical strategies, and training pre- and in-service teachers to examine their teaching behavior in the classroom. The products of classroom interaction studies are represented in a variety of publications (Amidon and Hough, 1967; Amidon and Hunter, 1966; Amidon and Flanders, 1967).

Gage (1968) has identified three variables which have consistently appeared in teacher behavior studies: teacher warmth, teacher indirectness, and teachers' logical grasp of the material to be taught (cognitive organization). Individual studies correlating these teacher variables with student achievement measures tend to be unimpressive when viewed in isolation. However, as Gage notes, the consistency with which these patterns are found to be correlated with student growth enhances their status as desirable teaching behaviors and as variables worthy of further investigation. Further evidence for the importance of teacher indirectness as a desirable teacher behavior has been recently presented by Campbell and Barnes (1969) and Soar (1969), although the latter paper suggests a curvilinear relationship in which some medium level of teacher indirectness would be optimal with too much as well as too little indirectness being less desirable.

Gage's statement is more positive than those of earlier writers (Medley and Mitzel, 1963; Morsh and Wilder, 1954), who concluded that attempts to correlate specific teacher behaviors with child gain data had been unsuccessful. The appropriate conclusion at present seems to be that classroom observation research is beginning to pay off, as Gage suggests, but the strength of relationships discovered has not matched expectations. If this is a fair estimate of the current situation, what is its explanation? What are the causes for this relative lack of success?

The search for "desirable teacher behavior" assumes, at least implicitly, that a specific set of teacher behaviors can be identified which will prove to be desirable in most situations. However, as

Mitzel and Gross (1956) have pointed out, teacher effectiveness is very likely multi-dimensional and determination of what is effective teaching behavior may be dependent upon the goals sought in the specific situation. Furthermore, the curvilinear relationship between teacher behavior and child achievement that Soar (1969) suggests for teacher indirectness may prove to be a general phenomenon applying to most teacher behavior dimensions.

Another set of problems lies in the limitations of some of the systems themselves. These are discussed in a review by Meux (1967), who recommends overcoming the deficiencies of individual systems by constructing a super-system containing the best facets of each. Meux (1967) also calls for movement away from simple frequency count systems towards more sophisticated levels of analyses along lines already initiated in several systems. Meux particularly stresses the need to take into account subject-matter differences and other considerations which may imply differential instructional objectives (and therefore differential "desirable teacher behavior"). He stresses also the need to get at the cognitive processes underlying observed behavioral differences and to retain the continuity of cycles of initiation and reaction within topic units. Development along these lines would increase the sophistication of classroom observation systems and enable them to exert more power in ordering the data. With or without such development, however, similar benefits can also be achieved by a shift from the class to the individual student as the basic unit to be considered in analyzing the data. Most systems presently in use, either as they are or with modifications in the way data are recorded, could be analyzed in this way. Historically, investigators have tended not to do this, however, so that interaction analysis findings are reported in terms of the class as a unit, ignoring intra-class variation. Although it has seldom been explicitly considered, the choice of the class as the unit in research that attempts to establish desirable or optimal teaching behavior implies at least two tacit assumptions of questionable validity: (1) the idea that the interaction variables being studied are properly

conceptualized as interactions between the teacher and the class as a group rather than as dyadic interaction between the teacher and a single student and (2) the idea that teachers are consistent across students in their classroom behavior so that individual differences within a classroom are of little or no importance relative to inter-class differences.

The validity of these two tacit assumptions will be considered in the following sections.

Dyadic Interaction

Many coding categories are properly conceptualized as reflecting interaction between the teacher and the class as a group. This is particularly true of behavior related to the clarity, specificity, and organization of the teacher's lectures when engaged in expository teaching. At such times the teacher is addressing the class as a group. The situation is different, however, with teacher behavior relevant to the measurement of teacher warmth and indirectness. Much teacher behavior coded as instances of these teacher characteristics occurs in dyadic interactions, although it is ordinarily coded as teacher-class interaction. Praise, criticism, acceptance of feelings, use of student ideas, and similar teacher behaviors are typically directed to individual students rather than to the class as a whole. Certain other teacher behaviors, such as asking questions or attempting to initiate discussion, are addressed to the class as a whole but are also dependent upon student initiative for response. If there is great variation among students in their tendency to respond in such situations, these too may be more profitably considered from the standpoint of the student rather than the class as the relevant unit.

Even if it is granted that the behaviors listed above should be conceptualized as variables of dyadic interaction rather than of interaction between the teacher and the class as a group, analyses based on the class as the unit might still be justifiable on the grounds that intra-class variation is of little importance relative to inter-class variation, so that the objections raised amount to very little practical difference. Are teachers consistent in their treatment of

different children in their class on the dimensions considered, or are there important individual and group differences within the classroom that need to be taken into account? Evidence bearing on these questions is presented in the following section.

Intra-Class Differences in Teacher-Child Interaction

A survey of classroom interaction data reveals that within-class group and individual differences of considerable importance are regularly found when the investigator chooses to focus on them. Children differing in social status, sex, or achievement level regularly differ in the type of interactions they have with their teacher. Davis and Dollard (1940) related that lower class children typically monopolize teacher criticisms, while teacher rewards go to the higher class children more regularly. A teacher interview study by Becker (1952) found that teachers voluntarily made evaluations and based classroom strategies in terms of social status of the pupils they taught. Hoehn (1954) failed to substantiate a hypothesized relationship between quantity of teacher contact and social class status of the student. His data did suggest a qualitative difference, however: low achieving students received a greater proportion of conflictive and dominative teacher contacts, while high achieving students received more promotive and supportive contacts. Lahaderne (1967) also suggests that the quality of teacher-student interaction differs with the level of student achievement. deGroat and Thompson (1949) reported that teacher praise was more frequently extended to high achievers, with duller students receiving a disproportionate share of teacher disapproval. Good (1969) examined teacher-afforded response opportunities and teacher feedback in four first-grade classrooms and concluded that students whom the teachers perceived as high achievers received more response opportunities and more positive feedback than did students perceived as low achievers.

It has frequently been suggested (St. John, 1932; Davidson and Lang, 1968; Ayers, 1909) that elementary school is more meaningful for girls than for boys, because the great majority of teachers are

female. To the extent that this statement is true, it is likely that much of the explanation lies in the teacher's explicit classroom behavior rather than in the teacher's sex per se. That is, teachers may be differentially treating boys and girls in ways that favor girls. One example appears in teacher evaluative comments, since it has been regularly reported that teachers have more disapproval contacts with boys than they do with girls (Meyer and Thompson, 1956; Lippitt and Gold, 1959; Jackson and Lahaderne, 1957).

Differential teacher treatment of students has also been shown in teacher grading practices. Carter (1952) examined the correlation between grades and measured achievement in six classes and concluded that boys had been graded lower than their actual achievement dictated. Hadley (1954) investigated the relationship between grades and achievement in 20 fourth, fifth and sixth grade classrooms and concluded that teachers tend to grade their most liked students higher and to penalize their least liked students by assigning them lower grades.

Large individual differences in classroom interaction patterns were noted long ago by Horn (1914), who examined the distribution of student opportunity for participation in classroom recitations in 229 classrooms. Horn reported that students ranked by teachers in the highest quartile in "general all-around ability" did about 40 per cent more reciting than those in the lowest quartile. This inequality was found to increase with grade level so that "the amount of reciting done by the fourth quartile grows increasingly less with an advance in grade, so that in the high school, the best quartile does almost twice as much reciting as does the poorest quartile (page 24)." Similarly, Anderson and Brewer (1945) found that teachers tend to focus their dominative and integrative comments on only a few students in the classroom and concluded that "the range of frequencies of individual contacts showed that individual children in the same room lived in widely different psychological environments (page 153)." Jackson and Lahaderne (1967) vividly express the same conclusion: "for at least a few students, individual contact with the teacher is as rare as if they were seated in a class of 100 or more pupils, even

though there are actually only 30 or so classmates present.... This observation calls into question the conventional view of looking upon each classroom as a unit whose participants have shared a common educational experience (page 13)."

The Individual Student as the Unit of Analysis

In reacting to the findings presented above we reach conclusions similar to those expressed by Yamamoto (1967), who also questions the exclusive view of the class as a group receiving constant teacher treatment: "We are so accustomed to looking at the class as a group that we forget this aggregate of pupils is unique in many ways.... Classroom groups are seldom, if ever, affected as a group by their achievement as a group. In essence, students are competing against each other as individuals and not against other groups as a group.... The teacher is talking -- but to whom? His verbal communication may represent either the direct or indirect influence category, and he may indeed be influencing students -- but specifically whom, why, and how? One third of the time, students talk -- but which students and to whom? (p. 207-209)." We share Yamamoto's reservations, and conclude that the need to treat the student as the unit of analysis for classroom interaction data is dictated by both theoretical considerations (many of the teacher behaviors actually studied occur in dyadic interaction and are not directed to the class as a group) and empirical data (large individual differences and regular group differences have consistently been demonstrated to exist within the classroom).

Use of the individual student as the unit in classroom interaction analysis is not a new idea; in fact, early proponents of the method (Horn, 1914; Puckett, 1928; Wrightstone, 1934) presented it primarily as a method for studying the student rather than the teacher. Later, however, when more formalized systems began to appear, the method was ordinarily presented as a means of studying the teacher, with the class treated as a group. This has become the traditional, almost exclusive method of analyzing interaction data, even though there appears to be no theoretical or practical reason why analysis should not be performed

from the point of view of the student as the unit. More recently, application of behavior modification paradigms to classroom intervention has led to the emergence of the opposite approach -- idiosyncratic study of the individual student without attention to the class as a whole. Classroom observation of the student is a major and integral part of the behavior modification technique. The child's interaction with his teacher is observed in an attempt to discover the cues and reinforcement controlling the child's classroom behavior as a prelude to intervention, and at the same time these observation data provide a baseline from which later progress can be measured (Clarizio and Yelon, 1967; Valett, 1966; Woody, 1966). However, such studies are usually concerned only with the individual child and his particular interaction with the teacher. They do not ordinarily involve applications of the sort advocated here, in which differential treatment of different children by the teacher or group differences within the classroom are the primary focus of study.

Given that analysis based on the class as a unit may not always be appropriate, are there reasons to shift to the individual student or subgroups of students, other than by default? Two persuasive, substantive reasons favor such a shift in strategy: problems involving the relationship between previously studied teacher behavior variables and student performance could be approached with a more powerful research design, and classroom interaction analysis techniques could be brought to bear in research on classes of problems to which they have not previously been applied.

The typical study attempting to relate teacher behavior to child performance, because it treats the teacher and the class as a unit, requires data-gathering in a large number of classes for statistical reasons, since each class constitutes only a single observation within the design used. Shift to the teacher-child dyad as the unit of analysis would eliminate the need for a large sample of classrooms. More extensive sampling in the individual class would be required to compensate for the greater fluctuation in individual scores as compared to the class mean, but nevertheless the time and effort needed

to investigate a particular problem at a given level of measurement reliability and generality would be greatly reduced. At the same time, and of even greater importance, a more direct and powerful test of the hypothesis would be possible.

In studies using the class as the unit, intra-class individual differences are left out of the model altogether or included only as error variance. It has been argued by Sidman (1960) that such a strategy is inefficient compared to alternate strategies which strive to reduce error variance by gaining greater experimental control over the phenomenon under study. Thus, if it is true, for instance, that teacher warmth is a variable applying primarily to dyadic interaction between the teacher and individual students rather than to interaction between the teacher and the class as a group, the appropriate way to test for a relationship between teacher warmth and student achievement would be to relate measures of teacher warmth towards particular individuals to the achievement of those same individuals. This has not typically been done in classroom interaction research, however; the usual practice has been to seek relationships between a mean warmth score (or mean indirectness score, etc.) for the teacher and the mean achievement level for the class. It seems likely that much of the explanation for the relatively weak effects in such studies lies in the failure to take into account important variation in teacher-child dyads. If the distribution of teacher warmth toward particular students in her classroom is seriously skewed (some of the data reviewed above suggest that this may be a frequent phenomenon) teachers could actually be misclassified. That is, a teacher who very frequently praised and otherwise exhibited warmth towards four or five students in the classroom might appear medium to high in "teacher warmth" in comparison with other teachers in the sample, even though her "warmth" was not extended to the majority of the students in her class. For the majority of the children in such a class, low rather than high teacher warmth characterizes teacher-child interaction. The likelihood of such phenomena suggests that attempts to test the relationship of teacher warmth to student achievement by using mean

scores for the teacher and the class are too indirect, that an adequate test of the hypothesis requires the use of the teacher-child dyad as the unit of analysis. This conclusion would also apply to teacher indirectness and to certain other variables traditionally studied with classroom interaction analysis.

Besides providing a more powerful design for studying variables traditionally included in classroom interaction analysis research, a shift to the individual student as the unit of analysis would allow extension of the technique to other problems for which it is an appropriate but seldom used procedure. In particular, the method can be used to focus on individual and group differences within the classroom, establishing relationships between differential teacher treatment of different children and individual difference measures from those children. Furthermore, <u>those systems featuring retention of initiation-reaction sequences can go beyond such correlational analyses and establish the cause-and-effect mechanisms producing the discovered relationships between teacher and child behavior</u>. One wonders, for example, whether the frequently reported finding cited above that teachers tend to express more disapproval toward boys than girls is due more to teacher discrimination or to differences in the behavior of the children. That is, boys may bring greater teacher disapproval upon themselves by initiating more disapproval behavior than girls, in which case the differences in rate of teacher disapproval may be seen as due to consistency on the part of the teacher in reacting to stimulus events which occur more often among boys than among girls. Alternatively, the sex difference may be due in part to a more proactive tendency on the part of the teacher to express more disapproval toward boys than toward girls when stimulus events are statistically controlled. Questions such as these are potentially resolvable through the application of classroom interaction observation techniques to individual difference phenomena. An extended example of one such application taken from the authors' work on the communication of teacher expectation in the classroom is presented in the following section.

Teacher Expectations

Present work by the authors on the communication of teacher expectations for child performance in the classroom provides an example of a classroom interaction analysis study using the individual student as the unit but addressing itself to teacher behavior and group difference variables. Rosenthal and Jacobson (1968) excited the educational world with their assertion in Pygmalion in the Classroom that teachers' expectations for student performance function as self-fulfilling prophecies, such that positive teacher expectations lead to increased student performance. The "expectancy effects" in the data presented by Rosenthal and Jacobson are not as consistent as the authors' interpretations of them would suggest, however, and even the support that they do provide is questionable for methodological reasons (Barber and Silver, 1968; Snow, 1969; Thorndike, 1968). Even if such criticisms are dismissed and the reality of expectation effects is assumed, the Rosenthal and Jacobson treatment of the problem remains incomplete because it contains only antecedent and consequent measures without attention to the intervening processes producing the effects. As a result, secondary sources aimed at parents and teachers have tended to present their data in over-simplified or even magical language, suggesting that spectacular results may be obtained by simple changes in teacher attitudes (wish and it shall be true). Partially in reaction to this, we have initiated a study of the phenomenon which attempts to get at the underlying processes so that expectation effects, if they exist, may be seen as the outcome of observable sequences of behavior. The research assumes the following model: a) The teacher forms differential expectations for student performance; b) the teacher then treats the children differently in accordance with his differential expectations for them; c) different children will respond in different ways to the teacher because they are being treated differently by him; d) in responding to the teacher, each child will tend to exhibit behavior which complements and reinforces the teacher's particular expectations for him; e) as a result, the general academic

performance of some children will be enhanced while that of others will be depressed, with change being in the direction of teacher expectations; f) these effects will show up in the achievement tests given at the end of the year, providing support for the "self-fulfilling prophecy" notion.

Systematic investigation of the full model from beginning (how do teachers form differential expectations in the first place?) to end (how do children change so as to begin to conform more closely to teacher expectations?) will require a series of interrelated studies. Initial efforts have been concerned with the second step -- differential treatment of different children by the teacher in accordance with differential expectations for their performance. Measures of teacher expectation were gathered by asking teachers to rank their students in order of achievement. Six children high on the list, (three boys and three girls) and six children low on the list were selected for individual study in each classroom. Selection of subjects from the ends of the distributions of teachers' rankings was designed to maximize the chances of discovering differential treatment of the students, if such exists. As a balancing factor, however, the data were collected in a school system which practices tracking, assigning children with similar scores on readiness and achievement tests to the same classroom. Thus, at least in terms of test scores, objective differences in potential among the children (and, therefore, objective support for the validity of teacher expectations) was minimized.

Since the object of the research was to focus on differential treatment of different children, the observation system developed was addressed only to dyadic contacts between the teacher and an individual child, with lecture-demonstration and other teacher behavior directed to the class as a group being ignored. The types of dyadic interactions coded included response opportunities (recitations, reading turns in the reading groups, answers to open or direct questions), teacher-afforded communications (individual feedback regarding seat work, asking the child to perform procedural or caretaking functions,

disciplinary action or evaluative comment about the child's behavior), and contacts initiated by the child (calling out answers, showing work to the teacher or asking questions about it, seeking permission or other contact for procedural matters). Care was taken to code each interaction separately according to whether it was initiated by the teacher or by the child so that later the relative effects of each upon the nature of the dyadic interaction could be evaluated. Continuity of sequence was also maintained in the coding system for certain sequences of interaction. Whenever the teacher asked an open question (addressed to the class as a whole rather than to a particular student), for instance, each child was coded for whether or not he raised his hand to seek an opportunity to respond. Whenever the child did get a response opportunity, coders kept track of both the nature of his response (correct, partially correct, incorrect or no response) and the nature of the teacher's subsequent feedback (praises, criticizes, gives the answer, repeats the question, rephrases or gives clue, gives no feedback at all).

After being perfected in several pilot studies, the system was applied for about ten hours of observation made on four different days in each of four first-grade classrooms. Although data analysis is only partially completed, it is clear that huge differences exist in the ways that the teachers interact with the two groups of students. Large sex differences are also obvious, especially in disapproval contacts, as has been reported previously. Perhaps unsurprisingly, students high on the teachers' lists initiated more contacts with the teachers, raised their hands more, received more response opportunities, produced both a greater number and a greater proportion of correct answers when they did have a response opportunity, and received more praise and less criticism than children low on the lists. Less predictably, however, and more in line with the suggestions of Rosenthal and Jacobson, analysis of the sequential data reveals pro-active teacher behavior that goes beyond the objective differences among the children and suggests that teachers may be enhancing these differences rather than reducing them through

compensation techniques. We find, for instance, that the high children received more praise not only in the absolute but also in the relative sense; that is, even though they give many more right answers, they are more likely to be praised for a right answer when they give it than the low children are to be praised when they give a right answer. Even more revealing are the data regarding teachers' reactions when a child gives a wrong answer, doesn't know the answer, or gets stuck while reading in the reading group. When children high on the teachers' lists experienced such difficulty, the teachers repeated the question, rephrased the question, or gave a clue 67 per cent of the time; they gave the answer or allowed another child to give it 33 per cent of the time. For the children low on the lists, however, these percentages are 38 per cent and 62 per cent respectively. The data suggests, then, that despite the differences in absolute performance rates among the groups, teachers demanded better performance from those children for whom they had higher expectations and were more likely to praise such performance when it was elicited. In contrast, the teachers were more likely to accept poor performance from students for whom they held low expectations, and they were less likely to praise good performance from such students when it occurred even though it occurred less frequently.

Such findings would seem to constitute evidence that teachers do in fact communicate differential performance expectations to different students in their classroom behavior, and they illustrate the usefulness of classroom observation and interaction analysis for systematic investigation in this area.[1] Several related studies of these phenomena are being planned, involving study of change in the nature of teacher-child interaction over the school year and evaluation of the effects of intervention into the process after accumulation of baseline observation data. In addition to the study of communication of teacher expectation, similar methodology could be applied to the study of the effects of other

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[1]A full report of this research is being prepared by the authors and will be circulated through the Report Series of the Research and Development Center for Teacher Education.

types of individual difference variables on the nature of dyadic interaction in the classroom. Differences in status due to ascribed group membership (sex, socio-economic status, race, etc.) or to idiosyncratic characteristics (teacher like or dislike, physical appearance) can also be profitably studied in this way.

Conclusion

Traditional interaction analysis studies treat the classroom as a group as the unit of analysis. This usage involves two key assumptions: (a) the interaction variables being studied are properly conceptualized as interactions between the teacher and the class as a group and (b) teachers are consistent across students in their classroom behavior so that individual differences within a classroom are of little or no importance relative to inter-class differences. Data and arguments were presented to challenge these two assumptions. It was demonstrated that many coding categories are most properly conceptualized as interactions between teacher and individual student. A variety of findings were reviewed to illustrate that within-class group and individual differences of considerable importance are regularly found when investigators look for them.

Two major benefits acrue when classroom data are analyzed with individual students as the unit of analysis: (a) problems involving the relationship between previously studied teacher behavior variables and student performance measures can be approached with a more powerful research design, and (b) classroom interaction analysis techniques can be brought to bear in classroom research on problems and variables to which they have not previously been applied. Practical application using the student as the unit of analysis was exemplified in the authors' work on the communication of teacher expectations in the classroom.

In summary, it is argued that to answer certain research questions the individual student is the proper unit of analysis. Use of the classroom as the unit of analysis in such circumstances masks important data and constitutes a less powerful method of examining the relationship between selected teacher behavior variables and student performance measures.

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